2. Remarks

Specification

The specification was objected to as failing to provide proper antecedent basis for the claimed subject matter, in particular the OA states that "a solution comprising two or more dissolved metals" as recited in original claim 1 was not in the body of the disclosure. The disclosure as amended alleviates the objection by incorporating the language of originally filed claims and does not raise issue of new matter.

Claim Objections

Claim 1 was objected to on the basis of informalities, and a change was suggested. Claim 1, now rewritten as new claims 25, 30 and 38, was amended accordingly.

The Examiner noted that the phrase "two or more" in Claim 1 was interpreted for examining purposes to relate to "dissolved metals" and not to "metal-containing compounds". Claims 25, 30 and 38 clarify the intended interpretation of the phrase.

Claim Rejections – 35 USC § 102

Claims 1-6 and 8 were rejected under 35 U.S.C. 102.

Claims 1 and 2, now rewritten as new claim 25, were rejected under 35 U.S.C. 102(e) as being anticipated by Brezny (US 5,919,727). The applicants respectively traverse this rejection.

Brezny discloses a method for making a composite mixed-metal powder comprising cerium oxide and at least one other non-noble metal oxide in solid solution (column 1, lines 60-65; and column 2, lines 24-25). Brezny cites as suitable non-noble metals transition metals and rare earth metals, preferably Zr in Group IVA and Y, La and Ac in Group IIIA (column 2, lines 37-43). The sole example given by Brezny relates to a solution of cerium and zirconium salts pyrolyzed in air to form oxides of zirconium and cerium atomically mixed and in complete solid solution (column 3, lines 24-45).

The present invention teaches new art that comprises physical differences from that disclosed by Brezny. The present application teaches a method for making mixed-metal particles comprising two Group IIB metals, comprising Cu and at least one metal from Group IIIB, or comprising at least one metal from each of Groups IIIB and IVB. The Groups of the periodic table are defined here as: Group IIB includes Zn, Cd and Hg; Group IB includes Cu, Ag and Au; Group IIIB includes B, Al, Ga, In and Tl; and Group IVB includes C, Si, Ge, Sn and Pb. These materials are different in their nature and chemistry from transition and rare earth metals addressed by Brezny. The new art disclosed by the present invention is patentably distinct from Brezny and would not be obvious to one skilled in the art.

Accordingly, applicants respectfully submit that the new claims are patentable over Brezny.

Claims 1, 3, 4 and 6 were rejected under 35 U.S.C. 102(b) as being anticipated by Berndt et al (US 4,624,941). The applicants respectively traverse this rejection.

The new claim structure simplifies the overall claim structure. Claims 1 and 3 are now rewritten as new claims 38 and 39. Claims 1 and 4 are now rewritten as new claims 30 and 31. Claim 6 is now rewritten as new claims 33 and 39.

Berndt et al disclose a method for making a composite powder comprising a noble metal non-oxide phase and at least one rare earth metal oxide phase, said composite powder produced by spray pyrolysis in the presence of oxygen (column 2, lines 20-21). Berndt et al define noble metals to include Au, Ag and the platinum group metals (column 2, lines 16-18), and identify suitable preferable noble metals to include Pt, Pd, Rh and Ru (column 2, lines 57-60). Composite powders prepared by the method disclosed by Berndt et al comprise at least one rare earth oxide (column 2, line 19), and Berndt et al identify suitable rare earth elements to include Ce, La, Pr and Nd (column 2, lines 55-57). Example 1—the sole example of a material effected in accordance with the invention (column 5, lines 9-10)--discloses spraying a solution comprising Pt, Rh and La into an oxygen-containing atmosphere to form a composite powder.

The present invention teaches new art that comprises physical differences from that disclosed by Berndt et al. The present application teaches a method for making mixed-metal particles comprising two Group IIB metals, comprising Cu and at least one metal from Group IIIB, or comprising at least one metal from each of Groups IIIB and IVB. These materials are different in their nature and chemistry from the Group IIIA and VIIIA materials addressed by Berndt et al. The new art disclosed by the present invention is patentably distinct from Berndt et al and would not be obvious to one skilled in the art.

In specific reference to claim 6, now rewritten as new claims 33 and 39, the Office Action notes that the Examiner takes the position that the disclosure by Berndt et al of powder in which a metallic noble metal phase and at least one rare earth oxide phase are in a virtually homogeneous distribution (column 2, lines 66-68 and column 3, lines 1-2) equates to the metallic phase being enveloped with an metal oxide phase as disclosed in claim 6 of the present invention. The inventors of the present invention respectfully submit that this is a misunderstanding of what is meant by substantially enveloping in the present invention. In the present invention, substantially enveloping is used to denote particles comprising at least two separate, segregated phases where one phase substantially envelops the second. For example, in the specification on page 18 in the third full paragraph that begins, "Embodiments where one or more phases substantially envelop other phases...," the phrase "substantially envelop" is defined by example to mean one phase (e.g. Cu_2O) around a subparticle core of another phase (e.g. In_2O_3). The resulting heterogeneous, multi-phase particles as disclosed in the present invention are distinct from and have unanticipated advantages over the homogeneous particles disclosed by Berndt et al.

Accordingly, applicants respectfully submit that the new claims are patentable over Berndt et al.

Claims 1 and 3-5 were rejected under 35 U.S.C. 102(b) as being anticipated by Douglas et al (US 4,023,961). The applicants respectively traverse this rejection.

Claims 1 and 3 are now rewritten as new claims 38 and 39. Claims 1 and 4 are now rewritten as new claims 30 and 31. Claims 1 and 5 are now rewritten as new claims 30 and 32.

Douglas et al disclose a method for making a composite powder comprising multiple metal phases, comprising both a metal phase and a metal oxide phase, or comprising multiple metal oxide phases. Douglas et al disclose making powders comprising one or more metallic phases comprising elemental Ag, Au, Pd, Pt or any combination of these metals (column 2, lines 20-22). Douglas et al disclose making powders comprising at least one metallic phase comprising at least one of these metals and at least one oxide phase (column 2, lines 27-31).

The present invention teaches new art that comprises physical differences from that disclosed by Douglas et al vis-à-vis composite powders comprising one or more metal phases. The present application teaches a method for making mixed-metal particles comprising two Group IIB metals, comprising Cu and at least one metal from Group IIIB, or comprising at least one metal from each of Groups IIIB and IVB. These metals are different in their nature and chemistry from those addressed by Douglas et al. These differences distinguish new claims 30, 31 and 32 over Douglas et al.

Douglas et al also disclose a method whereby a first solution comprising dissolved metals is reacted with a second solution comprising a reducing agent (column 3, lines 6-12), a hot organic liquid medium (column 4, lines 11-19), or a precipitating medium (column 6, lines 46-49) to make powders comprising one or more metal oxide phases. The present invention teaches new art that comprises physical differences from that disclosed by Douglas et al. The present application teaches a method for making mixed-metal particles comprising multiple oxide phases whereby a solution comprising two Group IIB metals, comprising Cu and at least one metal from Group IIIB, or comprising at least one metal from each of Groups IIIB and IVB is formed into droplets and the droplets are heated to pyrolyze the contents of the droplets for form particles comprising multiple oxide phases. The method disclosed in the present invention comprises significant physical differences from the chemical reaction disclosed by Douglas et al. These physical differences distinguish new claims 38 and 39 over the chemical reaction embodiment of Douglas et al.

Douglas et al also disclose a method whereby a solution comprising a dissolved Ag compound is used to make composite powders comprising Ag by a process that comprises thermal decomposition without a chemical reaction with a second solution (column 9, lines 47-66). The broadest possible reading of Douglas et al might be construed to teach that composite powders comprising multiple oxide phases could be formed by thermally decomposing a solution comprising multiple dissolved metals; but only one of the many examples given by Douglas et al discloses making powders with multiple oxide phases, and that one example includes a chemical reaction with a precipitating medium (column 9, lines 20-22), and the only example that Douglas et al give of a process comprising thermal decomposition without chemical reaction with a second solution involves processing Ag-containing solutions in an oxidizing environment (column 9, lines 57-61). The general teachings and multiple specific examples of the present invention disclose new art wherein for example atomization and thermal decomposition in an oxidizing environment of an aqueous solution comprising dissolved Cu and In yields single-phase Cu-In oxide powder (page 11, lines 22-24; and Example 1 on pages 28-29), whereas powder comprising multiple oxide phases is obtained with thermal decomposition in non-oxidizing environments (page 11, lines 24-28 and page 12, lines 1-4; and Example 2 on

page 29). These unexpected results distinguish new claims 38 and 39 over the thermal decomposition embodiment of Douglas et al.

The present invention teaches new art that is patentably distinct from Douglas and that would not be obvious to one skilled in the art.

Accordingly, applicants respectfully submit that the claims as amended are patentable over Douglas.

Claims 1 and 8 were rejected under 35 U.S.C. 102(b) as being anticipated by Cumberbatch (EP 297799). The applicants respectively traverse this rejection.

Claims 1 and 8 are now rewritten as new claims 25 and 27, 30 and 35, and 38 and 41.

Cumberbatch discloses a method for forming $CuInSe_2$ films by spray pyrolysis. Spray pyrolysis involves preparing a solution containing one or more dissolved reactants and spraying the solution onto a heated substrate in a manner as to decompose the solution and deposit a solid film on the substrate. Spray deposition generally involves atomizing a solution using, for example, pneumatic, ultrasonic or other means; Cumberbatch discloses using airless electrostatic atomization (column 3, lines 47-50). Independent of the specific spraying means, spray pyrolysis generally aims to deposit a solid film; Cumberbatch teaches a method of epitaxially growing a solid thin film of $CuInSe_2$ on CdS or ZnCdS (column 3, lines 53-55). This first embodiment disclosed by Cumberbatch does not involve particulate materials as are the purview of the present invention.

Cumberbatch also discloses a method of forming films by electrophoretic deposition from a colloidal suspension prepared by precipitation from a reactant solution comprising dissolved reactants (column 4, lines 2-13). This second embodiment disclosed by Cumberbatch does not involve atomizing the reactant solution to form particles as is the purview of the present invention.

The present invention teaches new art related to a method of preparing mixed-metal particles from pyrolyzed droplets. Nothing in Cumberbatch relates to particles prepared by such means, and no combination of embodiments in Cumberbatch suggests such means.

The present invention teaches new art that is patentably distinct from Cumberbatch and that would not be obvious to one skilled in the art.

Accordingly, applicants respectfully submit that the new claims are patentable over Cumberbatch.

Claim Rejections – 35 USC § 103

Claim 7 was rejected under 35 U.S.C. 103(a) as being unpatentable over Cumberbatch (EP 297799) in light of Wiesmann (US 4,536,607). The applicants respectively traverse this rejection.

As discussed above, Cumberbatch discloses a method for forming solid $CuInSe_2$ films by spray pyrolysis. Wiesmann discloses a multi-junction photovoltaic device comprising a $CuInSe_2$ film produced by methods known in the art, including film deposition by spray pyrolysis. Nothing in Cumberbatch or Wiesmann, separately or in combination, relates to droplet pyrolysis methods of making particles. Even if combined, Cumberbatch and Wiesmann do not meet the claims of the present invention.

The new art disclosed by the present invention is patentably distinct from Cumberbatch in light of Wiesmann and would not be obvious to one skilled in the art.

Accordingly, applicants respectfully submit that the claims as amended are patentable over the cited art and should be allowed.

Conclusion

For all of the above reasons, applicants submit that the claims are now in proper form, and that the claims all define patentably over the prior art. Therefore they submit that this application is now in condition for allowance, which action they respectfully solicit.

Conditional Request for Constructive Assistance

Applicants have amended the claims of this application so that they are proper, definite, and define novel matter that is also unobvious. If, for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. ' 706.03(d) and ' 707.07(j) in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

The applicants can be reached by telephone at (805) 987-7258.

Very Respectfully,

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2003 June 27 Chris Eberspacher

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2003 June 27

Chris Eberspacher, Applicant